Jasna Prester [1]
Najla Podrug [2]
Maja Darabos [3]

INNOVATION CLIMATE AS A SOURCE OF COMPETITIVE ADVANTAGE

Abstract

Innovation is the result of the interactions and exchanges of knowledge involving a diversity of actors in situations and interdependences (Landry, Amara, & Lamari, 2002). Innovation requires the convergence of different kinds of knowledge from different types of actors (Landry et al., 2002). There is scarce literature measuring innovation potential. In this work the well-known Tidd et al. (2005, pp. 566-568) instrument for measuring innovation climate is used. The instrument measures five categories, namely strategy, processes, organization, ties and learning. On grounds of an internet survey of the Croatian manufacturing sector Croatian innovative audit is presented. The survey targeted 2443 Croatian manufacturing companies with over 10 employees. After two months of the launch of the survey 135 valuable questionnaires are obtained. The instrument shows that Croatian average innovation climate index is 4,7 out of 7 which means that there is much potential for improvement. Using factor analysis the questionnaire is tested, because so far we could not find the validation of the instrument. The results show that indeed the instrument has high validity. Then using structural equation modeling, the effects of organizational climate on new product launch, time to market and revenues from new products is evaluated. The results show that strategy and learning have the biggest influence on number of innovations; ties have the biggest influence on time to market of new products, and organization has the biggest influence on revenues from new products.

Keywords

competitive advantage, Croatia, innovation audit, innovation climate, structural equation model

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1. Introduction

Sudies show that there is a high correlation between business results and innovation (IFP, 2003). New products, either modifications or radically new products enable to capture new market or retain the existing market share (Tidd, 2006). In case of existing products, competitiveness and growth of revenues comes not only from price reductions but also from various nonfinancial factors as better design, customization and enhanced quality (Govindarajan and Gupta, 2001). Life cycle of products is becoming ever so short and life cycle of mobile phones and MP3 players are now measured in months. Slightly more

[1] Faculty of Economics and Business Zagreb, Croatia, e-mail: jprester@efzg.hr
[2] Faculty of Economics and Business Zagreb, Croatia, e-mail: npodrug@efzg.hr
[3] Faculty of Economics and Business Zagreb, Croatia, e-mail: mdarabos@efzg.hr

complex products such as cars have life cycles measured in a year. It is important to launch a new product before the competition; because that creates a temporary monopoly that will bring additional revenues until the competition catches up. That means that it is vital to launch new products but also to launch them before the competition. This puts a tremendous pressure on today's companies (Tidd et al, 2005, p.5; BCG, 2010). When talking about innovation usually it is assumed that the term means new modified products or radically new products. However, process innovations are of equivalent importance. Process innovations enable companies to work more efficiently, of better quality and more productively (OECD, 2005). Studies show that incremental innovations may cumulatively bring better efficiency and gains in the long run than sporadic radical innovations (Hollander, 1965; Hammer, 2004). The current literature does not provide comprehensive frameworks for the measurement of innovation capability and its effects. Input measurement evaluates how the innovation activities have been arranged and how resources are allocated to them. It includes the funds used in R&D activities and education. Input measurement is problematic, because it tells how much is devoted, not if anything has been accomplished. Output measurement mainly includes the organization's patents and licenses. The problem of output measurement is that they are only suitable for certain types of innovations and organizations (Tura et al., 2008). Becheikh et al. (2006, p. 649) on grounds of works of Archibrugi and Pianta (1996), Coombs et al. (1996), Hagedoorn and Cloodt (2003), Kleinknecht et al. (2002), Michie (1998) and Patel (2000) list pros and cons of indirect and direct measurement of innovation. Becheikh et al. (2006, p. 649) propose direct methods, via questionnaires, asking for number of new products, revenues form new products, time to market and level of R&D investments in order to bypass the negative sides of indirect measurement of innovation. The aim of this work is to analyze in what way organizational climate for innovation (Tidd et al., 2005, pp. 566-568) influence direct measures of innovation defined by Becheikh et al. (2006, p. 649). Furthermore, it will be analyzed how each of the five dimensions of innovation climate (strategy, processes, organization, ties and learning) influence direct measures of innovation.

2. Innovation climate

Even from the time of Schumpeter it is known that new products represent potential for growth of companies but also better living conditions for population in general. Therefore in the nineteen sixties it was very popular to heavily invest in R&D departments. Unfortunately, after ten years or so, it was found out that higher level of investment in R&D does not yield more new products. Research has shown that innovation depends on number of factors, such as economy, organizational culture, management etc. To illustrate the complexity of innovation Trott (2009, p. 8) stresses three important steps in the innovation process:

- Generation of new knowledge for innovation,
- Usage of acquired knowledge for generating new products and processes,
- Economically benefit from new products launched on the market.

The three steps depict that innovation and its commercialization is indeed an interdisciplinary process. Innovation necessities are teamwork and creative deployments of various types of knowledge. Researches also show that proactive human resources

management will have a positive effect on business results (Pfeffer, 1998; Ahmad and Schroeder, 2003; Mathieson, 2006) and on innovation (Laursen and Foss 2003; Lau and Ngo, 2004; Dorenbosch et al., 2005; McLean 2005).

Creative climate is developed through organizational culture which in some part is a function of proactive human resources management. Organizational culture is complex but can be defined as common values, beliefs and norms of behavior. Management of the company cannot easily change the culture and it is usually built by stimulating and compensating desired behavior. Building innovation culture requires compensating innovations. Organizational innovation climate is less tangible and by far more difficult to measure, but according to Akkermans (2008), can be influenced more easily.
Lamers (2007), Tidd et al., (2005) and many other authors researched what fosters innovation. There is still no consensus; however in all researches a common set of themes were present in all innovative companies.

- Strategy – the upper management highly supports and propagates innovation
- Ties – it is vital that there exist a very good communication inside and outside of the company
- Processes – innovation necessities that the company can quickly adapt through efficient rules and procedures
- Organizational structure – it has to be designed to support innovation
- Learning – that is the basic element for generating new knowledge

Tidd et al. (2005) questionnaire captures all those dimensions and therefore was chosen to investigate the Croatian innovation climate.

3. Methodology and sample description

The survey took place in June 2013 exclusively via a web based survey. The e-mail addresses were obtained from Croatian Chamber of Economy. The questionnaire was sent to 2443 companies with more than 10 employees. The reason for this cut off on 10 employees is because in micro companies a lot of different tasks are done by one person so it would be harder to isolate specific influences. After a month 135 completed questionnaires were obtained representing 5,53% response rate. This is quite low but it is attributed to the web based survey for which is usually to yield lower response rate than paper surveys.

All participants obtained their personal innovation audit in a day. However, the sample was checked for representativeness by size and industry and it proved to be representative. In the sample 64% of companies were small companies with less than 50 employees, 22% medium sized companies (50 – 250 employees), and 14% of large companies with more than 250 employees.

Even though there is still recession in Croatia, 34,6% companies will invest more into research and development. For the time being small companies on average invest 10,88% of sales, medium companies 8,58% of sales and large companies 5% of sales. This might look inconsistent, however since small companies usually have smaller revenues it is logical that

they have to invest more in percentage points to get a comparable budget as large companies. 64% of respondents say that R&D investment is too low.

As it can be seen in Table 1., the companies in Textile and Apparel industry and Pharmaceutics on a Likert scale from 1- non important to 5 most important think that innovation is key for staying competitive. The average of all companies is 4 modified products and 3 completely new products which is quite high, and contrary to current belief, it is actually medium and bigger companies that innovate more. The development phase for modified products is on average 5 months, while for new products more than 7 months.

Industry	Importance
C14 Apparel And Other Finished Products Made From Fabrics And Similar Materials	4,7
C21 Pharmaceutics	4,7
C26 Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	4,1
J58 Software development	4,0
C13 Textile Mill Products	3,7
J62 Computer programing and consulting	3,6
C28 Industrial And Commercial Machinery And Computer Equipment	3,6
C15 Leather And Leather Products	3,5
C17 Paper And Allied Products,	3,5
C20 Chemicals And Allied Products	3,5
C22 Rubber And Miscellaneous Plastics Products	3,5
C27 Electronic And Other Electrical Equipment And Components, Except Computer Equipment	3,5
C32 Miscellaneous Manufacturing Industries	3,5
C30 Manufacture of other transport equipment	3,3
J63 Analysis of data, Web design	3,3
C25 Fabricated Metal Products, Except Machinery And Transportation Equipment	3,0
C10 Food And Kindred Products	3,0
C11 Beverages	3,0
C16 Lumber And Wood Products, Except Furniture	3,0
C23 Nonmetal and mineral products	3,0
C24 Fabrication of metal	3,0
C29 Manufacture of motor vehicles, trailers and semi-trailers	3,0
C31 Furniture And Fixtures	2,8
C18 Printing, Publishing, And Allied Industries	2,0

Table 1: *Importance of innovation by industries (1 – not important, 5-highly important)*

As far as revenues are concerned again an unpredictable result is obtained. On the whole sample greater returns are obtained from modified products than from radically new. It might mean that in modification less is invested and all together gain is bigger. For radically new product very much has to be invested first.

There is a discrepancy in the strategy component in the obtained results. In the questionnaire it showed that 71% responders see higher management as the leaders of innovation. However the question 7 questioned if this higher management vision is clear to

all employees the result was on average 4 on 7 point Likert scale, where 7 would be true, and 1 not true.

As for measurement of innovation, 62% of companies measure it by customer satisfaction and then revenues from new products (15%). The rest are other measures. As for impediments to innovation the dominant causes are too lengthy process, and deciding which project to give a green light since they are all inherently risky. Many complain about inadequate marketing of new products.

For the whole sample the innovation audit looks as presented on Figure 1.

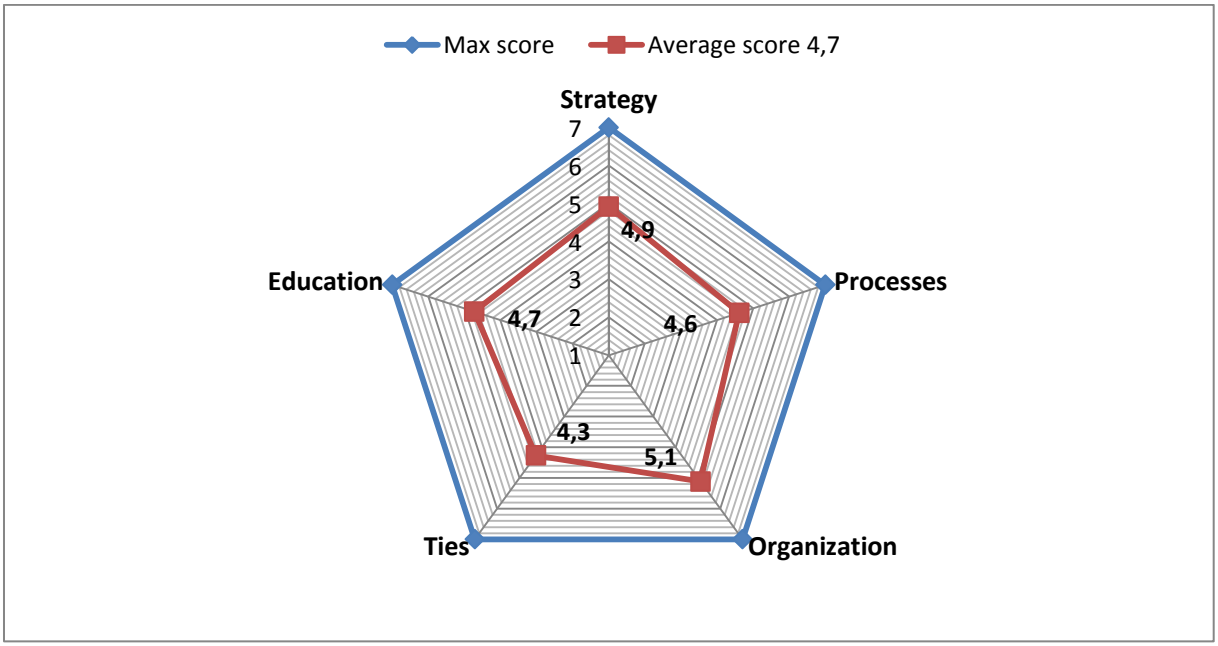

Figure 1: *Croatian innovation audit*

Figure 1 reveals that organization has the highest score meaning that the organization can quickly adapt to changes, but ties is the lowest score meaning that communication in house and with outside partners has to enhance.

4. Results

Literature research did not reveal the validness of the Tidd et al. (2005) instrument so our first step was to check the validity using Cronbach alpha test which is presented in Table 2.

Construct	Questions from the questionnaire*	Cronbach Alpha	Sig.
Strategy	f1 f6 f11 f16 f21 f26 f31 f36	0,918	0,000
Processes	f2 f7 f12 f17 f22 f27 f32 f37	0,899	0,000
Organization	f3 f8 f13 f18 f23 f28 f33 f38	0,906	0,000
Ties	f4 f9 f114 f19 f24 f29 f34 f39	0,851	0,000
Education	f5 f10 f15 f20 f25 f30 f35 f40	0,850	0,000

** Question can be found in Tidd et al. (2005, pp. 566-568)*

Table 2: *Cronbach alpha test of the constructs*

It can be seen that all Cronbach alpha values are over 0,8 which is very good. Then confirmatory factor analysis is conducted in order to see if the grouped questions fit in the proposed groups.

Method of Estimation: ML	Chi-Square Statistic: 2573,33
Discrepancy Function: 19,8	Degrees of Freedom: 740
Maximum Residual Cosine: 7,71E-005	Chi-Square p-level: 0,000000
Max. Abs. Gradient: 0,000149	Steiger-Lind RMSEA
ICSF Criterion: 2,53E-006	--->Point Estimate: 0,13
ICS Criterion: 0,000197	-->Lower 90% Bound: 0,125
Boundary Conditions: 0	-->Upper 90% Bound: 0,136
Joreskog GFI=0,822	RMS Stand. Residual: 0,431

Table 3: *Result of the confirmatory factor analysis*

All the parameters including Joreskog GFI (>0,8) are satisfactory and the model can be said to be valid and proven for further use.

However the main aim of this work is to see how each of these constructs relate to measurable outputs of innovation – number of new products, revenues from those products and time to market. Using structural equation modeling we obtained following results.

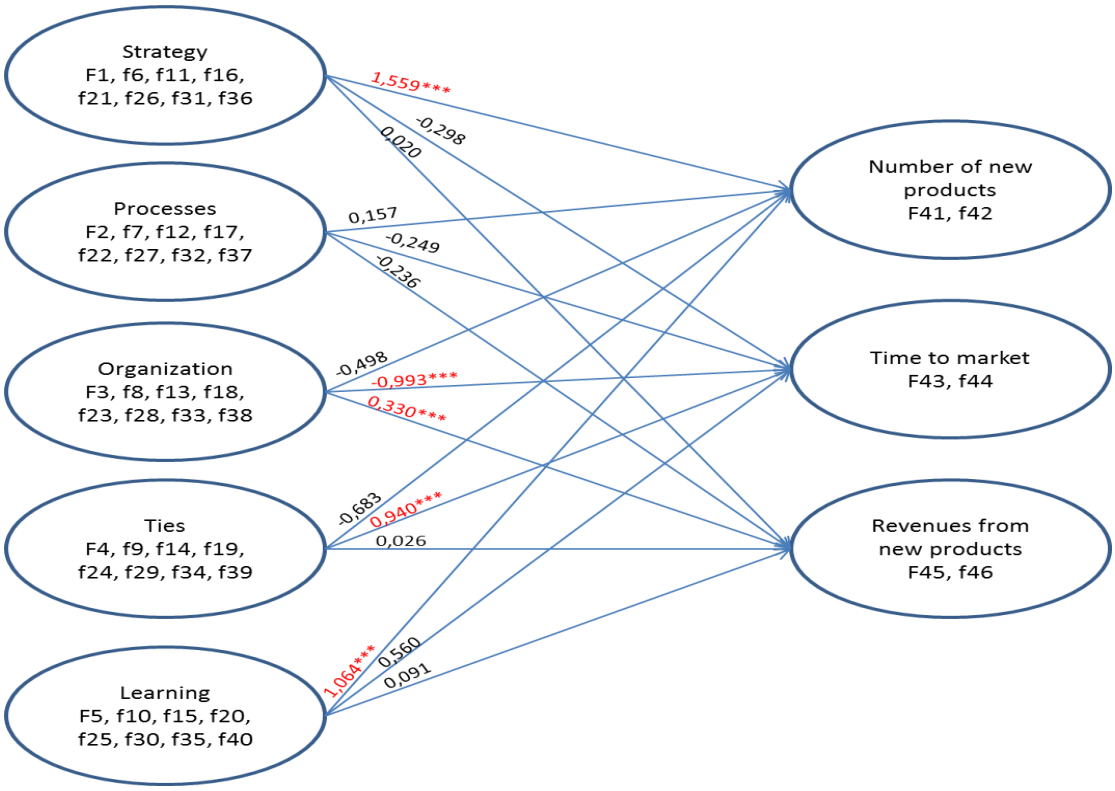

Figure 2: *Result of the structural equation model*

Before going into drawing conclusion from this model it is necessary to check if the model is valid. Therefore in Table 4 are characteristics and indicators of the model.

Method of Estimation: ML	Chi-Square Statistic: 2604,37
Discrepancy Function: 42,7	Degrees of Freedom: 974
Maximum Residual Cosine: 0,00283	Chi-Square p-level: 0,000000
Max. Abs. Gradient: 0,0157	Steiger-Lind RMSEA
ICSF Criterion: 0,00173	--->Point Estimate: 0,124
ICS Criterion: 0,00891	-->Lower 90% Bound: 0,116
Boundary Conditions: 1	-->Upper 90% Bound: 0,132
Joreskog GFI=0,927	RMS Stand. Residual: 0,429

Table 4: *Goodness of fit of the model*

Looking only at Joreskog GFI=0,927 it can be seen that the model shows extremely good model fit, so it is safe to draw conclusions.

In Figure 2. some indices are larger than 1 because those are not correlation coefficients but covariance. Looking only at the red significant values one can draw following conclusions:
1. The higher level management in propagation and rewarding innovation will in fact augment the number of new products.
2. Organization has a negative effect on time to market, and the more rigid organization is, it will it take more time to launch a new product. However, organization is extremely important for assuring commercial success of the innovation and that means that this organization is necessary for commercialization and it is not enough to have an idea of a new product.
3. Ties within the company and with outside partners will significantly lower time to market. It is good to invest into interpersonal relationships for innovation.
4. Learning significantly affects number of new products. So it is absolutely important to invest into R&D but also in employees' learning.

5. Conclusion

This work is a pilot project for conducting survey via internet in Croatia. It can be said that the response rate is lower than for the paper copies of questionnaires which even for survey of 12 pages deliver around 10% response rate. However we obtained 135 valuable answers which are enough for this investigation that we presented. The questionnaire had 40 questions taken from the Innovation audit Tidd et al. (2005, pp. 566-568) for measuring the innovativeness of the company, but with additional questions regarding number of new products (modifications and radically new products), time for development of new products (modifications and radically new products), and revenues from new products (modifications and radically new products). Each respondent in a couple of days received his personalized Innovation audit with recommendations where to invest into enhancing its innovation index.
Apart from descriptive statistics, the work represents the valuation of the Tidd et al. (2005, pp. 566-568) survey instrument using confirmatory factor analysis. We believe it is a valuable contribution since our search of literature did not show that someone already conducted this evaluation. The instrument is proven solid as by Cronbach alpha, so with model factor estimators. The most important part of this paper is the model how latent variables constructed from the questionnaire (strategy, processes, organization, ties, learning)

influence another set of latent variables (number of new products, time to market, revenues from new products). The model was tested and Joreskog GFI is over 0,9 which shows good model fit. The phenomenon of innovation is really a complex matter which includes not only engineering, employee knowledge, but also research in domains of psychology and sociology, and therefore it can be really sad with great assurance that it is an interdisciplinary process. Therefore this work is only a little part of an ongoing investigation in the field of innovation. Finally this work is a contribution to exploring the innovativeness of Croatian manufacturing companies with many recommendations for improvement.

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